

# Chapter Thirty-one

## CROSS SECTION ELEMENTS

BUREAU OF LOCAL ROADS AND STREETS MANUAL



**Chapter Thirty-one**  
**CROSS SECTION ELEMENTS**

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## Chapter Thirty-one

# CROSS SECTION ELEMENTS

### 31-1 ROADWAY SECTIONS

For rural cross sections, the roadway width is the combined width of the traveled way, any median, both shoulders, and any auxiliary lanes on the mainline facility. The traveled way is the combined width of all travel lanes. Figure 31-1A provides a typical cross section for rural 2-lane highways.

For urban cross sections, the roadway consists of the travel lanes, auxiliary lanes including parking lanes, any bike lanes or median, and curb and gutter. Figures 31-B through 31-1E provide typical cross sections for urban streets. The roadway width is measured from face-to-face of curbs. The tables in Chapters 32 and 33 provide the face-to-face widths based on the functional classification, traffic volume, and project scope of work.

#### 31-1.01 Travel Lane Widths

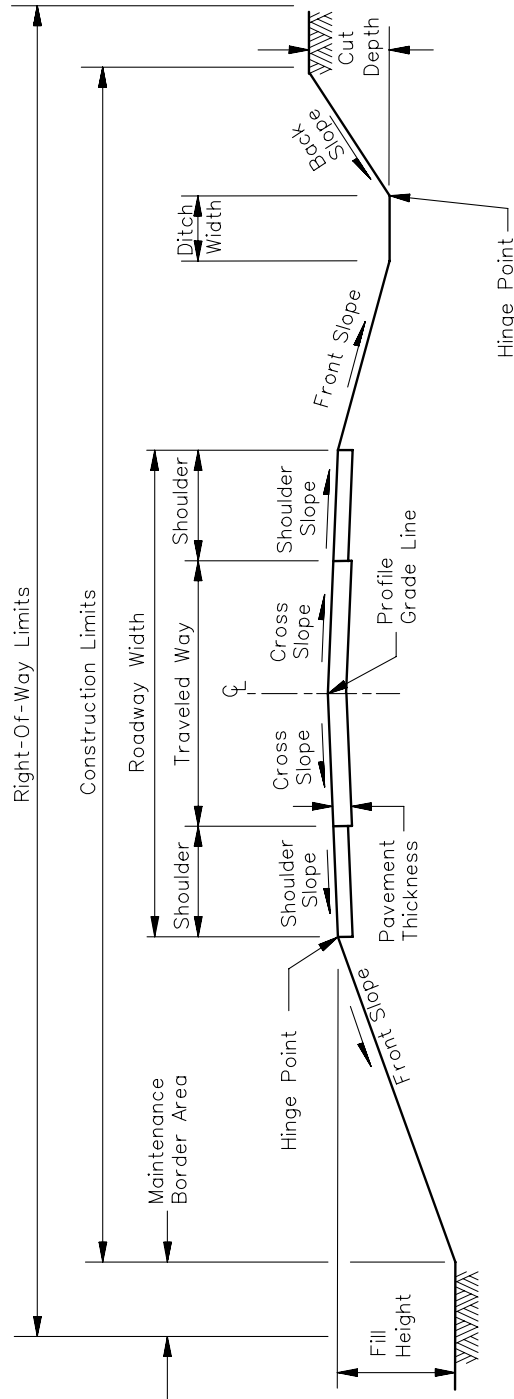
##### 31-1.01(a) Rural

The lane width of a roadway greatly influences the safety and comfort of driving. On the local highway system, travel lane widths generally vary between 9 ft (2.7 m) and 12 ft (3.6 m) depending on functional classification, traffic volumes, and project scope of work. While lane widths of 12 ft (3.6 m) are desirable, lanes that are 10 ft (3.0 m) wide are acceptable on low-speed facilities and lanes that are 9 ft (2.7 m) are appropriate for low-volume roads. The tables in Chapters 32 and 33 provide specific travel lane widths for these parameters.

##### 31-1.01(b) Urban

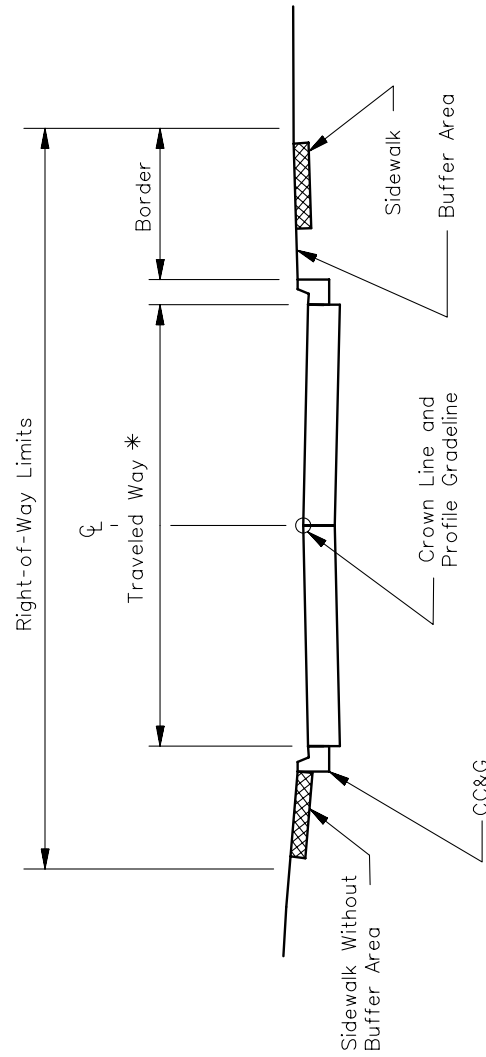
Consider the following for urban streets:

1. Local Streets. Travel lanes should be at least 10 ft (3.0 m) wide and preferably 11 ft (3.3 m). In industrial areas, travel lanes should be 12 ft (3.6 m). The width of new construction of local residential streets should either meet the criteria in Chapter 32 or the Institute of Transportation Engineers' publication *Guidelines for Residential Subdivision Street Design, A Recommended Practice*. Where right-of-way is restricted (e.g., additional right-of-way cannot be acquired due to economic, social, or environmental factors), travel lanes in industrial areas may be 11 ft (3.3 m).



**TYPICAL CROSS SECTION FOR RURAL TWO-LANE HIGHWAYS**

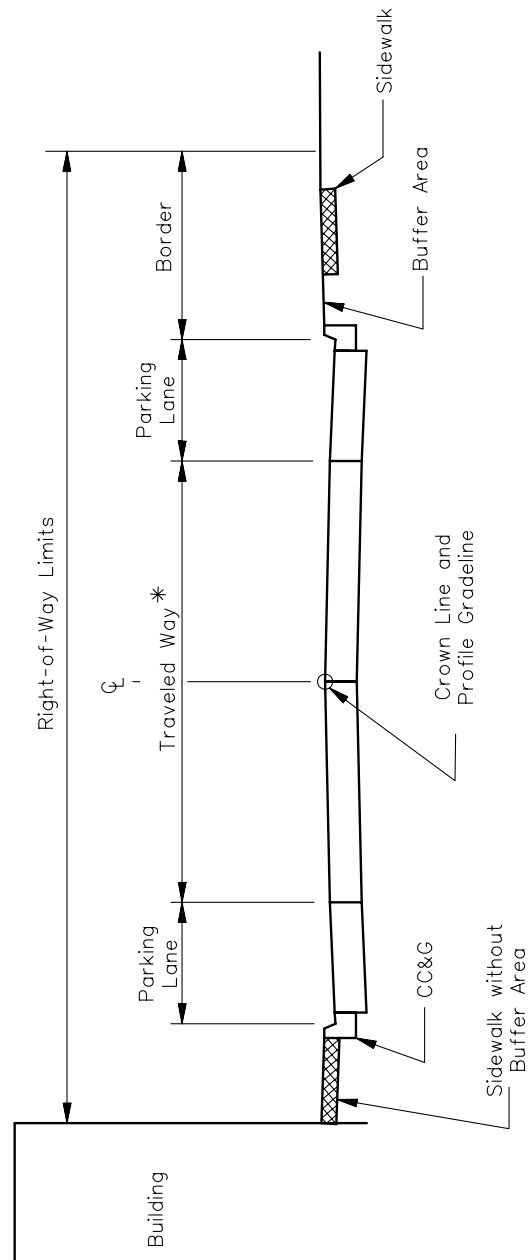
**Figure 31-1A**



\* The traveled way may have 2-way or 1-way traffic.

**TYPICAL CROSS SECTION FOR URBAN STREETS**  
(Two-Lanes Without Parking)

**Figure 31-1B**

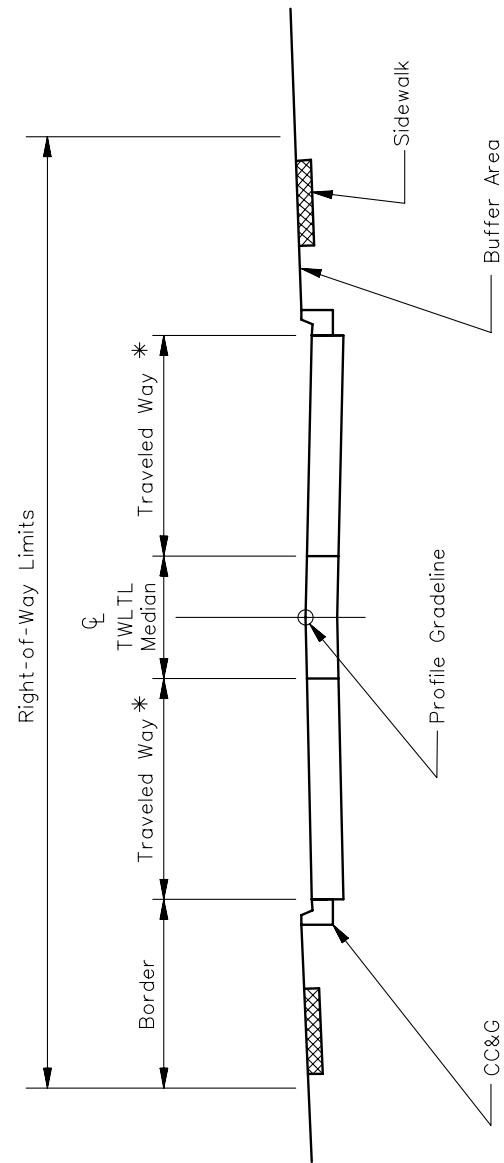


\* The traveled way may have 2-way or 1-way traffic.

**TYPICAL CROSS SECTION FOR URBAN STREETS  
(Two-Lanes With Parking Both Sides)**

**Figure 31-1C**

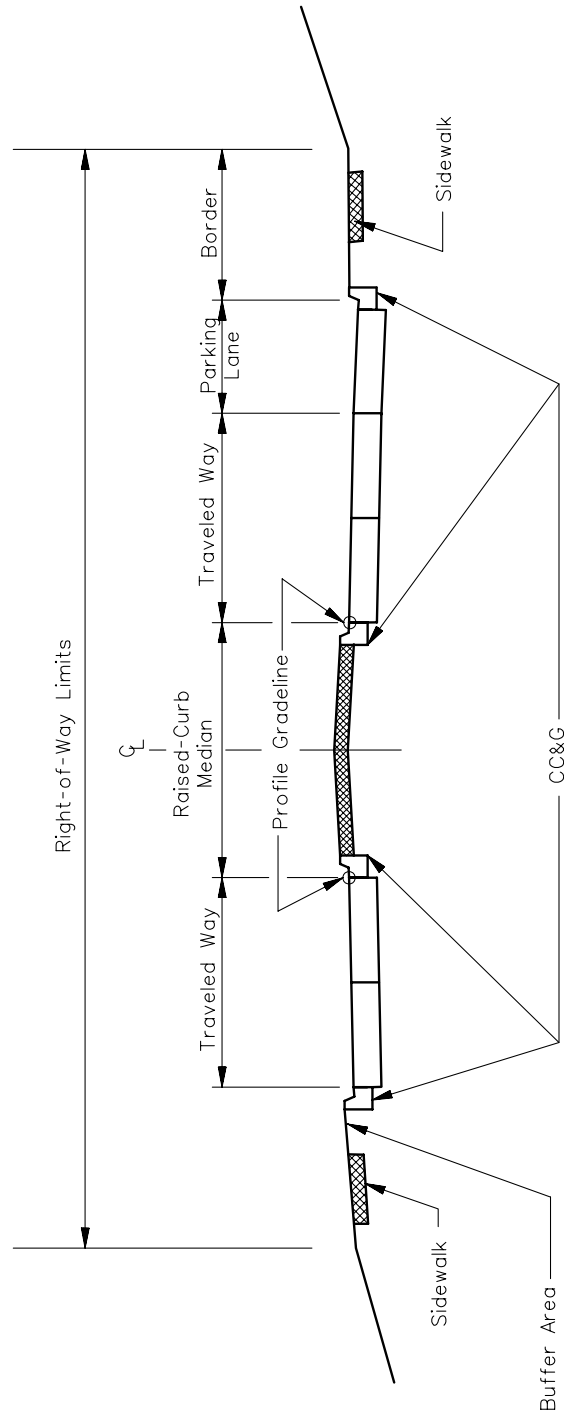




\* *Travelled ways may be either one or two lanes.*

**TYPICAL CROSS SECTION FOR URBAN STREETS  
(TWLTL)**

**Figure 31-1D**



**TYPICAL CROSS SECTION FOR URBAN STREETS  
(Raised-Curb Median)**

**Figure 31-1E**

2. Collector Streets. Travel lanes should range from 10 ft (3.0 m) to 12 ft (3.6 m). In industrial areas, travel lanes should be 12 ft (3.6 m), except where right-of-way is restricted. In this case, the travel lane may be 11 ft (3.3 m).
3. Arterial Streets. Travel lane widths may vary from 10 ft (3.0 m) to 12 ft (3.6 m). The 10 ft (3.0 m) width should only be used in highly restricted areas having little or no truck traffic. A 12 ft (3.6 m) travel lane should be provided, where practical, on free-flowing facilities with a 45 mph (70 km) design speed or where truck traffic is significant.
4. Bicycles. Lane widths may need to be increased to accommodate bicycles; see Chapter 42 for guidance and Chapter 32 for design criteria.

### 31-1.01(c) Bridges

In general, the approach roadway width should be provided across the bridge. For guidance on roadway widths across bridges, see Section 36-6.

### 31-1.02 Number of Lanes

#### 31-1.02(a) Rural/Suburban Facilities

For most rural and suburban local roads and collectors, capacity conditions normally do not govern and two travel lanes are generally appropriate. However, on suburban arterials, capacity needs may require more than two lanes. Where the design volume exceeds the capacity of an existing or proposed 2-lane arterial, consider the following alternatives to increase the facility's capacity:

- Improve the alignment and profile to decrease the gradient and increase the percentage of the total length of roadway with sufficient sight distance to afford opportunities for passing.
- Improve capacity by adding climbing or passing lanes.
- Improve capacity through intersections by adding auxiliary lanes (e.g., left-turn lanes).
- Alleviate delays caused by mid-block left turns by providing two-way left-turn lanes (TWLTL) in suburban areas to remove turning traffic from the through lanes. For additional guidance, see Section 31-1.05(b) and Section 48-4 of the *BDE Manual*.
- Modify the design to provide a 4-lane highway initially or as planned stage construction.

#### 31-1.02(b) Urban Facilities

The following guidelines apply to urban facilities:

1. Local and Collector Streets. For most local and collector streets, a minimum of two travel lanes is generally adequate. Where the current ADT is 10,000 or more, the number of through lanes should be determined by a highway capacity analysis of the intersections through lanes. Desirably, conduct this analysis using the future design traffic volume. Consider providing stage development where the analysis indicates four or more lanes are required. Where the improvement is developed by stages, initially a rural cross section with shoulders may be provided. At later stages, the shoulder can be converted to a parking lane or another travel lane usually with outside curb and gutter.
2. Local Residential Streets. In some instances, local residential streets may be designed with one travel lane plus two parking lanes. This would consist of a single 12 ft (3.6 m) travel lane with two 8 ft (2.4 m) parking lanes. Opposing conflicting traffic will yield and pause in the parking lane until there is sufficient width to pass. However, on residential streets experiencing crash problems or where the extent of parking does not allow traffic to safely weave and yield, the designer should either provide a wider street to allow two-way traffic or restrict parking on one or both sides of the street.
3. Arterial Streets. The number of travel lanes will vary on arterial streets, depending on traffic demand and available right-of-way. However, arterials will typically have four to eight lanes. Conduct a capacity analysis, including intersection and mid-block analyses, to determine the proper number of travel lanes.
4. Auxiliary Lanes. At some intersections, it may be appropriate to add auxiliary through lanes at an intersection to increase the capacity at the intersection. In some areas with numerous midblock left turns, consider providing a TWLTL.

### **31-1.03   Auxiliary Lanes**

Auxiliary lanes are lanes adjacent to the through traveled way. They are intended for use by vehicular traffic for specific functions. Auxiliary lanes include:

- single left- and right-turn lanes at intersections;
- double left-turn lanes at intersections;
- acceleration/deceleration lanes at intersections;
- two-way, left-turn lanes (TWLTL);
- parking lanes; and
- passing or climbing lanes.

Desirably, auxiliary lanes should be the same width as the adjacent through lanes, although in many cases a greater or lesser width may be appropriate. For local streets, the turn lanes should be 10 ft (3.0 m) wide or greater. For collectors and arterials, the turn lanes with few trucks may be 10 ft (3.0 m) wide and should be 12 ft (3.6 m) with higher truck volumes. The tables in Chapters

32 and 33 present specific width criteria for auxiliary lanes and curb type or shoulder widths adjacent to auxiliary lanes.

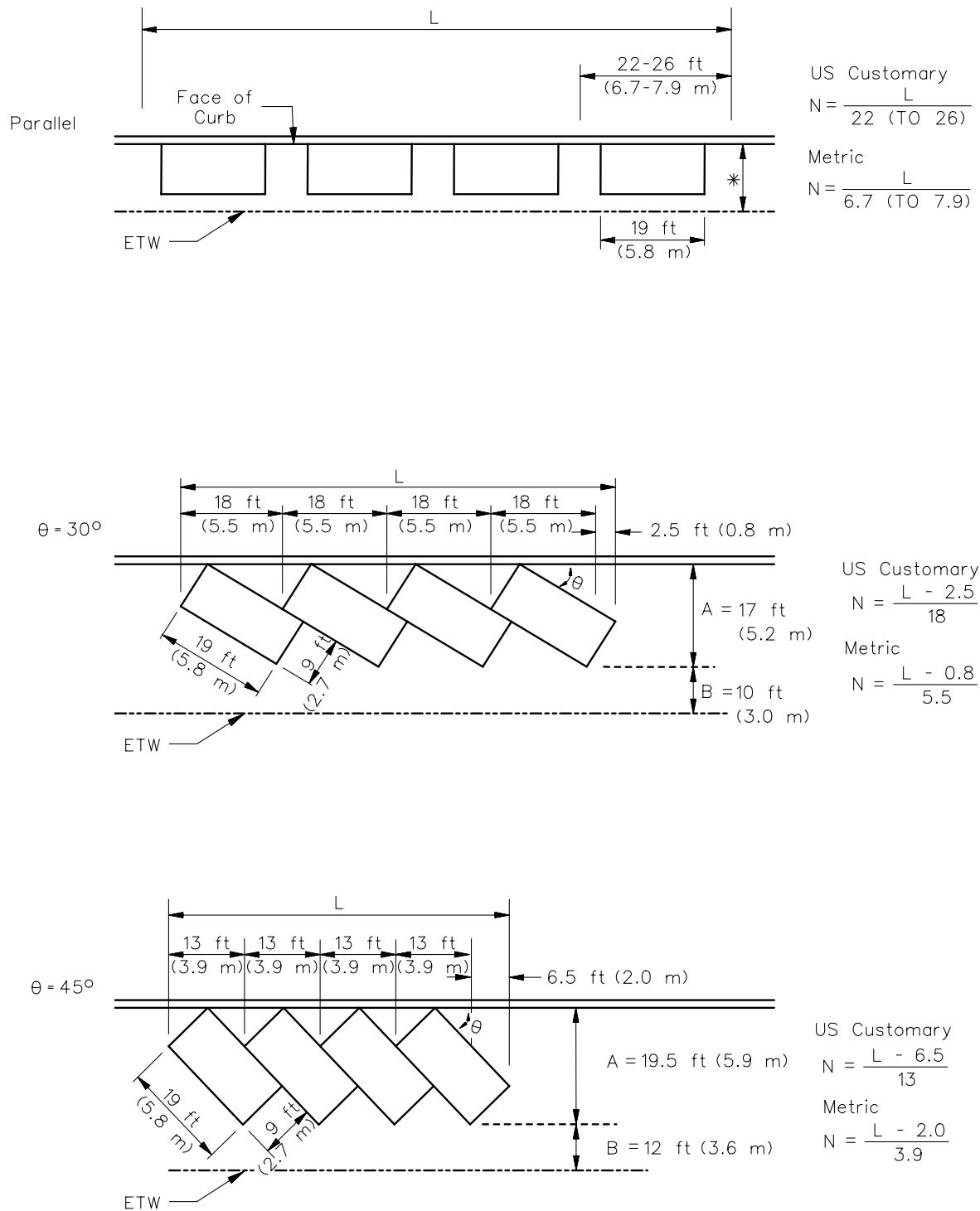
### **31-1.04   Parking**

For most urban projects, the designer should evaluate the demand for parking. Desirably, parking needs will be accommodated by providing residential parking or by providing off-street parking facilities. Section 41-2.02 provides guidelines for off-street parking. When providing on-street parking along urban streets, consider the following discussion.

#### **31-1.04(a)   Design Considerations**

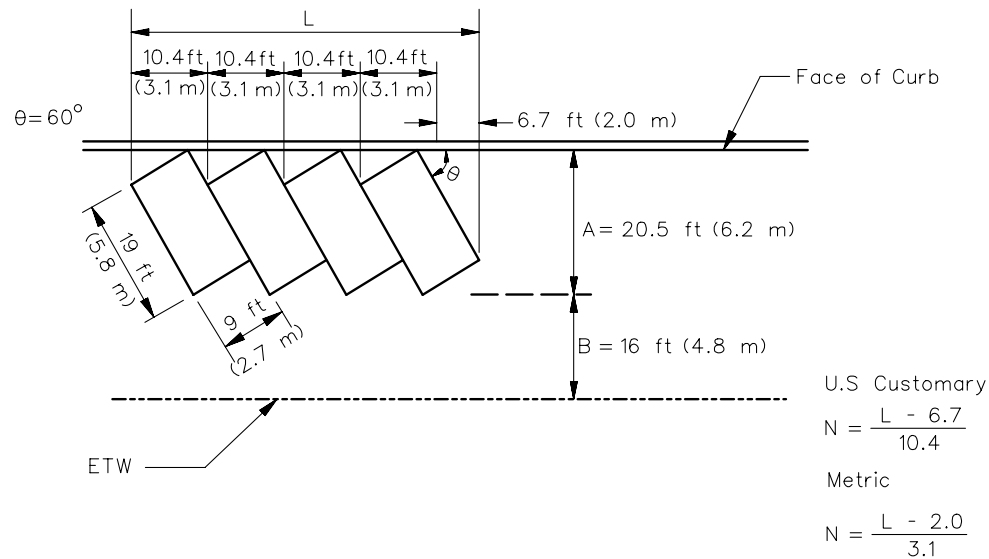
Section 31-1.04(b) provides guidance on parking lane widths. In addition, the designer should evaluate the following:

1.    Configurations. There are two basic types of on-street parking — parallel and angle parking. These are illustrated in Figure 31-1F. Consider the following:
  - a.    Capacity. Parallel parking is preferred when the street width is limited and traffic capacity is a major factor. Where angle parking is provided, the overall level of service for the facility preferably should be Level C or higher.
  - b.    Number of Spaces. Angle parking provides more spaces per linear foot (meter) than parallel parking, but requires a greater cross street width.
2.    Stall Dimensions. Figure 31-1F provides the width and a length criterion for parking stalls of various configurations. The Figure also indicates the number of stalls that can be provided for each parking configuration for a given curb length. The surface widths for urban streets shown in the tables in Chapter 32 assume parallel parking on one or both sides of the street.
3.    ADA Requirements. Section 41-6 presents the accessibility requirements for on-street parking for disabled persons.
4.    Parking Restrictions. According to the *Illinois Vehicle Code* (625 ILCS 5/11-1303), parking is prohibited in the following locations:
  - in front of a public or private driveway;
  - within an intersection;



**CURB PARKING CONFIGURATIONS**

**Figure 31-1F**



\*  $A + B$  = Parking Width. See Section 31-1.04(b) for parallel parking lane widths.

- Key:
- $L$  = given curb length with parking spaces, ft (m)
  - $N$  = number of parking spaces over distance  $L$
  - $A$  = required distance between face of curb and back of stall, assuming that bumper of parked car does not extend beyond curb face, ft (m)
  - $B$  = clear distance needed for a parked vehicle to back out of stall while just clearing adjacent parked vehicles, ft (m)
  - ETW = Edge of Traveled Way

Note: For 3R projects, lesser widths may be allowed; see Chapter 33.

## CURB PARKING CONFIGURATIONS

Figure 31-1F

(Continued)

- between a safety zone and adjacent curb or within 30 ft (9.1 m) of points on the curb immediately opposite the ends of a safety zone, unless a different length is indicated by signs or markings;
- within 15 ft (4.6 m) of a fire hydrant;
- within 20 ft (6.1 m) of any crosswalk;
- within 30 ft (9.1 m) on the approach leg to any intersection with a flashing signal, stop sign, yield sign, or traffic control signal located at the side of the roadway;
- within 20 ft (6.1 m) of the driveway entrance to any fire station and on the side of a street opposite the entrance to any fire station within 75 ft (22.9 m) of this type of entrance (when properly signed);
- within 50 ft (15.2 m) of the nearest rail of a highway/railroad crossing;
- on bridges or within a highway tunnel; and
- in areas designated by local traffic and enforcement regulations (e.g., near school zones, loading zones, bus stops). See local ordinances for additional information on parking restrictions.

### 31-1.04(b) Parallel Parking

In determining parking lane widths, consider the following:

1. Lane Conversion. Parking lane width determinations should include consideration for converting the parking lane into a travel lane during peak hour traffic or in the future (e.g., in areas where peak hour traffic may require additional through traffic lanes).
2. Measurement. Parking lane widths are generally measured from the face of the curb and typically include the gutter flag width. However, if the lane may be converted to a travel lane, the width should be in addition to that of the gutter flag.
3. Local Streets. Where used in residential areas, a parallel parking lane of at least 8 ft (2.4 m) should be provided on one or both sides, as appropriate to the conditions of lot size and intensity of development. In commercial areas, parking lanes should be 10 ft (3.0 m) wide and are usually provided on both sides.
4. Collector Streets. In residential areas, an 8 ft (2.4 m) parallel parking lane should be provided on one or both sides of the street, as appropriate for the lot size and density of development. In commercial and industrial areas, parking lanes widths should range from 10 ft to 12 ft (3.0 m to 3.6 m) and are usually provided on both sides of the street.
5. Arterial Streets. In general, parking along urban arterials should only be considered where it currently exists. However, parallel parking may be considered where adequate capacity is available in the through lanes and adequate parking is not available or practical on adjacent streets or off-street parking facilities. The parking lane width



should be 10 ft (3.0 m) to 12 ft (3.6 m) if there is a future possibility of being converted to a travel lane. This width is also adequate for an occasional parked commercial vehicle. Where it is unlikely there will be a future need to use the parking lane as a through or turn lane, the parking lane width may be as narrow as 8 ft (2.4 m).

A parking lane that is less than 12 ft (3.6 m) in width is considered undesirable if future use of the parking lane as a travel lane is anticipated. A parking lane 10 ft (3.0 m) in width is acceptable for use as a future storage lane for turning vehicles at signalized intersections by prohibiting parking for some distance upstream from the intersection.

### **31-1.04(c) Angle Parking**

Angle parking should be avoided where practical. However, when considering angle parking, the following applies:

1. IDOT Authority. When an improvement requiring IDOT approval is planned, any new or existing angle parking to remain must be approved by Central BLRS. In addition, the *Illinois Vehicle Code* (625 ILCS 5/11-1304(c)) states:

*Local authorities may permit angle parking on any roadway, except that angle parking shall not be permitted on any Federal-aid or State highway unless the Department has determined the roadway is of sufficient width to permit angle parking without interfering with the free movement of traffic.*

2. Street Width. The width of the street must be able to accommodate the existing traffic flow and should provide a clear distance for a parked vehicle to back out.
3. Backing Maneuver. Angle parking requires the driver to back into the traveled way where sight distance may be restricted by adjacent parked vehicles. This maneuver may surprise an approaching motorist. As indicated in Figure 31-1F, the parked car will require a distance "B" to back out of its stall. Whether or not this is a reasonably safe maneuver will depend upon the number of lanes in each direction, lane widths, operating speeds, traffic volumes during peak hours, parking demand, and turnover rate of parked vehicles.
4. Angle. Angle parking desirably should be 45° or less. In some conditions, a 60° angle for parking may be considered.
5. Adjacent Land Use. The adjacent land use must warrant the retention of the angle parking.
6. Crashes. After analyzing backing maneuver space, angle parking may be considered to remain if there is no history of crashes relating to the existing angle parking.

### **31-1.05    Medians**

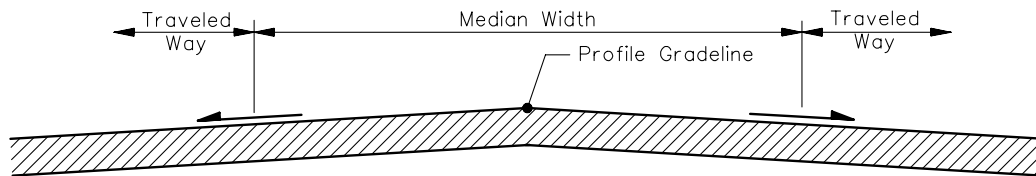
#### **31-1.05(a)    General**

Median design should be based upon economic, operational, and environmental considerations. The design will depend on the functional class of the highway, design speed, type of access management proposed, availability of right-of-way, construction costs, maintenance considerations, the anticipated ultimate development of the facility, operations at crossroad intersections, and field conditions. The median width is measured from the inside edge of the two traveled ways and includes inside shoulders and/or median curb and gutters. A median must be at least 2 ft (600 mm) wide to meet the minimum functional requirements. Section 31-1.05(b) and the tables in Chapter 32 provide guidance on recommended median designs for urban facilities.

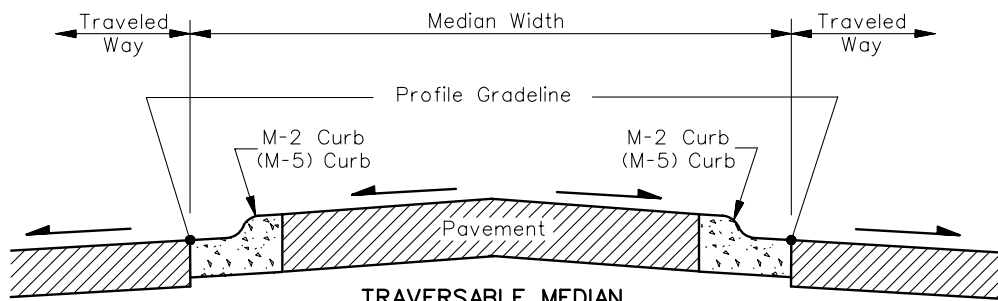
#### **31-1.05(b)    Median Types and Widths**

For rural type medians (e.g., depressed), see Section 34-3 of the *BDE Manual*. In addition, Section 34-3 of the BDE Manual discusses the advantages and disadvantages for these various median types. Figure 31-1G provides typical sections for the following median types — flush, traversable, and raised curb. The following provides brief descriptions on these types of medians. The following applies:

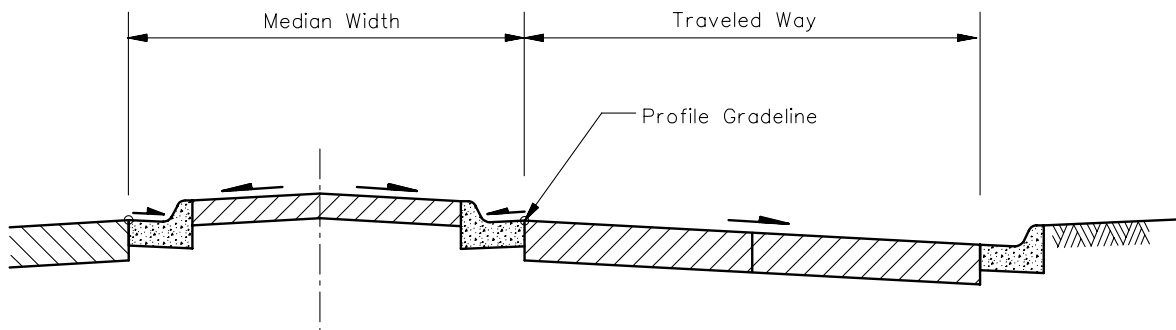
1.    Flush Medians. A flush median is defined where the surface is constructed as a smooth plane in conjunction with the adjacent roadway pavement and is usually distinguished with painted pavement markings. Flush medians are most often used on low-speed urban highways and streets. This flush type median should be slightly crowned to avoid ponding water in the median area. The following discusses typical flush medians:
  - a.    Flush. Typical widths for a flush median on an urban street can range from 2 ft to 14 ft (600 mm to 4.2 m). For urban arterials, the minimum width should not be less than 4 ft (1.2 m). To accommodate a separate left-turn lane, a flush median should desirably be 13 ft to 14 ft (3.9 m to 4.2 m) wide. This will allow for either an 11 ft (3.3 m) or 12 ft (3.6 m) turn lane and a minimum separation of 1 ft to 2 ft (300 mm to 600 mm) between left-turning vehicles and the opposing traffic.
  - b.    Two-Way Left-Turn Lanes (TWLTL). TWLTL are also considered flush medians. Operating speeds, truck and bus volumes, number and spacing of entrances and intersections, availability of right-of-way, character of abutting property, parking facilities, etc., should be considered when determining appropriate TWLTL lane widths. Typical TWLTL design widths range from 10 ft to 14 ft (3.0 m to 4.2 m). A minimum width of 12 ft (3.6 m) is desirable. For additional guidance on the selection and design of TWLTL, see NCHRP 395 *Capacity and Operational Effects of Midblock Left-Turn Lanes* and Section 34-3 of the *BDE Manual*.



**FLUSH MEDIAN**  
**PAINTED LEFT-TURN LANES**  
**OR TWLTL**



**TRAVERSABLE MEDIAN**



**RAISED-CURB MEDIAN**

**MEDIAN TYPES**  
**(Flush/Traversable/Raised-Curb)**

**Figure 31-1G**

2. Traversable Medians. On certain streets in large metropolitan areas where traffic volumes and mid-block left turns are unusually high, the traversable median with an M-2.12 (M-5.30) CC&G, although having a slightly higher initial cost than a flush median, may be the appropriate design option. This median type eliminates the frequent and somewhat hazardous striping operations and yet provides for TWLTL movements. Because the traversable median was developed as a direct substitute for the flush TWLTL, the M-2.12 (M-5.30) CC&G is not designed to be a physical barrier nor is it intended to impede left-turn movements across the median. The normal traversable median width for new construction is 16 ft (4.8 m).
3. Raised-Curb Medians. A median is defined as a raised-curb median if it contains a curb height greater than 2 in (50 mm) within its limits. Usually, a raised-curb median is proposed where there is a need to manage access to the street and to control left-turn movements.

For urban collectors and local streets, the raised-curb median width can be as narrow as 4 ft to 6 ft (1.2 m to 1.8 m) wide. For arterials and other high volume roadways, the recommended minimum raised curb median width is 18 ft (5.5 m). This width should only be used where the majority of intersections along the street will be signalized and have protected left turns. If many intersections do not require signalization, the recommended minimum width is 22 ft (7.0 m), assuming no right-of-way restrictions. The 22 ft (7.0 m) median width allows passenger vehicles to comfortably store within median crossovers at unsignalized intersections when making a maneuver in two moves. Where dual left-turn lanes are required, the minimum raised-curb median width is 32 ft (9.5 m) and desirably 35 ft (10.5 m).

Wider raised-curb medians (e.g., 4 ft (1.2 m) or wider) may be landscaped with turf or other low-growing plants. Ensure these plants are salt resistant and do not block the sight distances at intersections. See Section 41-10 for additional information.

### 31-1.05(c) Median Openings

On local streets, median openings should be provided as necessary to serve the abutting property and the traffic demand, but the number should be minimized. On collector and arterial streets, median openings should be provided only at street intersections and at reasonably spaced driveways serving major traffic generators (e.g., industrial plants, shopping centers). In addition, consider the following:

- Where practical, the median openings should include left-turn lanes; see Section 34-3 for the design of left-turn lanes.
- Ensure that there is adequate sight distance at the median opening; see Section 28-3.
- The shape and length of the median openings will depend upon the width of the median and the vehicle type that must be accommodated. See Section 36-4 of the *BDE Manual* for guidance on the design of median openings.

The minimum length of median openings should be that of the projected roadway width of the intersecting cross street or driveway. Desirably, the length of the median opening should be large enough to provide for a 50 ft (15 m) turning control radius for left-turning vehicles between the inner edge of the lane adjacent to the median and the centerline of the intersecting roadway.

### **31-1.06   Shoulders**

In urban and many suburban areas, the availability of right-of-way generally precludes the use of shoulders. However, many low-volume urban streets may have shoulders rather than a gutter, curb, or curb and gutter. Where shoulders are included, use the width provided from the rural tables in Chapters 32 and 33 for the applicable functional classification. Also, consider providing a curb and gutter or gutter at the outer shoulder edge. This may reduce construction costs and will confine drainage runoff to the shoulder area.

#### **31-1.06(a)   Functions**

The following are some of the important functions of shoulders:

- provides structural support for the traveled way;
- provides support for guardrail and prevents erosion around guardrail posts;
- prevents or minimizes pavement edge drop-offs;
- provides space for emergency and discretionary stops;
- improves roadside safety by providing more recovery area for run-off-the-road vehicles;
- facilitates maintenance operations (e.g., snow removal and storage);
- facilitates pavement drainage;
- provides space for pedestrian and bicycle use; and
- provides space for mailbox turnouts.

#### **31-1.06(b)   Shoulder Types**

There are several types of shoulders that may be used on local agency roads. A general discussion of the various shoulder types follows. The tables in Chapters 32 and 33 present the minimum requirements for shoulder types based on functional classification and design traffic.

1.     Paved. Paved shoulders are constructed with Hot Mix Asphalt (HMA) or concrete. They provide an all-weather surface with the ability to support occasional vehicle loads in all kinds of weather without rutting. Paved shoulders are usually used on arterials but may

- be provided on collectors, especially those with high-traffic volumes. In some instances, a shoulder curb may be included to control drainage.
2. Aggregate. Aggregate shoulders are considered stabilized shoulders. They usually have a minimum thickness of 6 in (150 mm). These shoulders help to eliminate the rutting and drop-off adjacent to the edge of the traveled way and provide an adequate cross slope for drainage of the roadway. Aggregate shoulders are provided on most collectors and on higher volume local roads.
  3. Turf. Turf shoulders are appropriate for most local roads and some low-volume collectors. These shoulders are unstabilized and generally undergo consolidation with time. Turf shoulders are subject to a buildup that may inhibit proper drainage of the traveled way. They require regular maintenance to correct drop-off at the edge of traveled way and to provide an adequate cross slope for drainage.
  4. Aggregate Wedge. An aggregate wedge is normally used on 3R-type projects. The aggregate wedge is placed at the edge of a resurfaced traveled way to account for the drop-off caused by the resurfacing thickness. This minimizes disturbance to the existing turf or aggregate shoulder.

### **31-1.06(c) Shoulder Widths**

Shoulder widths will vary according to functional classification, traffic volume, and the project scope. The shoulder widths for local roads and collectors normally vary from 2 ft to 8 ft (600 mm to 2.4 m). Where pedestrian and bicyclists are to be accommodated on the shoulders, a minimum usable shoulder width of 4 ft (1.2 m) should be provided. The tables in Chapters 32 and 33 present the minimum shoulder width criteria. The minimum shoulder width to a roadside barrier should be 4 ft (1.2 m). It may be appropriate to provide additional width behind the barrier to provide lateral support for the guardrail posts.

### **31-1.07 Curb and Gutter**

Curbs are used on urban and suburban facilities due to restricted right-of-way conditions and to control drainage, delineate pavement edges, channelize vehicular movements, manage access, provide separation between vehicles and pedestrians, and present an attractive appearance. In urban areas, curbs have a major benefit in containing the drainage within the pavement area and in channelizing or controlling traffic into and out of adjacent properties. In rural areas, curbing may be applicable where restricted right-of-way prohibits the use of a ditch section or to channelize traffic at isolated intersections.

#### **31-1.07(a) Usage Guidelines**

Selecting a curbed section or section with shoulders and outside ditches depends upon many variables, including vehicular speeds, urban/rural location, drainage, and construction costs. The

following discusses some of the factors the designer should consider when determining whether or not to incorporate a curbed section into the design:

1. Urban Location. Because of restricted right-of-way, the need to control drainage, and other constraints, curb and gutter sections on the outside edges of the traveled way are almost always used in urban areas.
2. Suburban Location. The use of curbs and/or gutters will be determined on a case-by-case basis. Consider providing curbing where there are pedestrians, channelization needs, closed drainage requirements, and a desire to manage access to the street.
3. Rural Location. In general, the use of sloping type curbs and/or gutters along rural high-speed highways is limited to the edge of shoulder and to the following special conditions:
  - for roadway delineation in conjunction with channelization at intersections;
  - where there is sufficient development along the highway and there is a need to channelize traffic into and out of properties;
  - where drainage control is required;
  - where right-of-way is restricted for roadside ditches; and/or
  - at other sites deemed necessary (e.g., interchange crossroads, major intersections with restricted sight distance, where the route turns, offset left-turn lanes).

### **31-1.07(b) Curb and Gutter Types**

There are two basic types of curbs — barrier (vertical) and mountable (sloping). The *IDOT Highway Standards* provides information on design details and placement for various curb types. For most situations, an integral concrete curb and gutter (CC&G) is used. The following notations are used by IDOT to define the various curb and gutter types:

1. Initial Letter. The initial letter “B” or “M” is used to denote whether the curb is barrier (vertical) type or mountable (sloping) type.
2. Numbers Prior to the Decimal Point. The first set of numbers indicates the height of the curb in inches (centimeters).
3. Numbers After the Decimal Point. The second set of numbers, if used, indicates the width of the gutter flag in inches (centimeters).

A Type B curb without a gutter flag can also be used in some instances.

The *IDOT Highway Standards* also includes information on gutter-only sections. These are used to control pavement drainage, especially for rural cross sections. They should be placed at the edge of the shoulder rather than along the edge of the traveled way because of their steep cross slope.

Some local agencies use a gutter section with a shallow flow line along the edge of the traveled way on residential streets. This avoids the need to depress the curb at the numerous entrances, especially on subdivision streets. This gutter section should only be used on streets functionally classified as local.

### **31-1.07(c) Curb and Gutter Type Selection**

The designer should consider the following guidelines when selecting a curb type:

1. Low-Speed Urban Facilities (Outside Edge of Traveled Way). Depending on the specific conditions, streets may be designed with either a mountable or barrier curb. Curb and gutter may be placed at the edge of the traveled way. Where the design speed is 45 mph (70 km/h) or less, B-6.24 (B-15.60), B-6.18 (B-15.45), or B-6.12 (B-15.30) CC&G may be used along the right edge of the traveled way or parking lane. A lesser gutter width may be used adjacent to a right-turn or parking lane or where highly restricted right-of-way conditions exist. Barrier curbs should be offset at least 1 ft (300 mm) and desirably 2 ft (600 mm) from edge of the travel lanes. Also consider any drainage requirements in the selection of gutter type. Some local agencies have standard curb types that can be used.
2. High-Speed Facilities (Outside Edge of Shoulder). In general, do not provide barrier curbs or continuous mountable curbs on high-speed facilities ( $V \geq 50$  mph (80 km/h)). Where a high-speed facility is proposed with shoulders and side slopes, there may be occasional locations where the right-of-way is restricted or there is a need to control drainage. In these cases, use an M-4 (M-10) or M-6 (M-15) type curb and gutter or a Type B gutter, depending on drainage needs, along the outside edge of the shoulder. Do not place curb and gutter or Type B gutter immediately adjacent to the edge of the traveled way.
3. Pedestrians. In urban areas, consider the use of B-9 (B-22) curb along the right edge of the traveled way where some additional protection is desired for pedestrians (e.g., adjacent to schoolyards, playgrounds). On roadways with low speeds, use the B-9 (B-22) curb adjacent to sidewalks across bridges. B-9 (B-22) curbs should not be provided along parking lanes.
4. Medians. On divided streets, the type of median curbs should be determined in conjunction with the median width and the type of turning movement control. Consider the following:
  - a. Traversable Medians. Where there is a need to provide a continuous 2-way, left-turn lane (TWLTL) along the street and where raised delineation of the center turn lane is desirable, use M-2.12 (M-5.30) CC&G to delineate the outside edge of the TWLTL.



- b. Raised Curb Medians. Where cross median movements are undesirable or hazardous, a raised curb may be provided. Use the following curbing types for raised curb medians:
- M-6.24 (M-15.60) or M-6.18 (M-15.45) CC&G on channelizing islands and medians where the design speed is less than 40 mph (60 km/h).
  - B-6.24 (B-15.60), B-6.18 (B-15.45), or B-6.12 (B-15.30) CC&G on channelizing islands and medians where the design speed is 45 mph (70 km/h).
  - For the design speed of 40 mph (60 km/h), the designer has the option to use either an M-6 (M-15) or B-6 (B-15) type curb and gutter.
  - Use M-4 (M-10) curb on channelizing islands or medians where the design speed is 50 mph (80 km/h) or greater. Typically, curbing is only used at locations that would be channelized (e.g., offset left-turn lanes), near at-grade intersections, or on the crossroad through an interchange.
  - Except for channelized intersections, raised-curb medians are generally not considered an appropriate type of median cross section where posted speeds will exceed 45 mph (70 km/h).
5. Corner Islands. On streets or highways with a design speed of 45 mph (70 km/h) or less, use the M-6 (M-15) curb on all corner islands. On facilities with design speeds of 50 mph (80 km/h) or greater, use the following curb types:
- Where traffic signals are not proposed, use an M-4 (M-10) curb with a specified gutter width on all corner islands adjacent to the high-speed facility.
  - Where traffic signals are present or proposed, use an M-6 (M-15) curb with a specified gutter width on corner islands adjacent to high-speed facilities.

### **31-1.08 Cross Slopes**

#### **31-1.08(a) Travel Lanes**

Surface cross slopes are required for proper drainage of the travel lanes on tangent sections. A sufficient cross slope reduces the hazards of wet pavements by quickly removing water from the surface. The following cross slopes will apply to travel lanes on tangent roadway sections:

1. High-Type Pavements. High-type pavements (i.e., hot-mix asphalt, concrete) are those that retain smooth riding qualities and good nonskid properties in all weather under heavy traffic volumes and loadings, with little maintenance required. For these pavements, use a cross slope of 1.5% to 2.0% and crown the traveled way pavement at the centerline. Use a minimum cross slope of 1.5% for the first lane away from the centerline. The second lane from the crown should have a cross slope of 2.0%.

2. Low-Type Surfaces. Low-type surfaces are treated earth surfaces, loose aggregate surfaces, and bituminous surface treatments. For low-type surfaces, the pavement cross slope should be 2.0% to 4.0%.

### **31-1.08(b) Auxiliary Lanes**

The rate of cross slope for an auxiliary lane will be at least 2.0% except for curbed left-turn lanes and TWLTLs. The designer may want to increase the cross slope by 0.5% for each additional set of lanes adjacent to the crown. Single left-turn lanes with curb and gutter are usually sloped at 1.5% to 2.0% away from the median to accommodate snow plowing. TWLTL and flush left-turn lanes are usually crowned at the centerline and sloped at a minimum of 1.5% in each direction.

### **31-1.08(c) Shoulders**

The cross slope of a shoulder depends on the type of shoulder and the construction project type. The following summarizes typical guidelines for shoulder cross slopes:

1. Paved Shoulders. On new construction and reconstruction projects, full-width paved shoulders on tangent sections should be sloped at 4.0%. On 3R projects, the shoulder slopes range from 2.0% to 6.0%.
2. Combination Shoulders. Combination paved/aggregate shoulders should be sloped at 4.0%.
3. Aggregate Shoulders. Aggregate shoulders should be sloped from 4.0% to 6.0%.
4. Turf Shoulders. Turf shoulders should be sloped from 5.0% to 8.0%.
5. Superelevated Sections. Section 29-3 and the *IDOT Highway Standards* discuss the application of shoulder cross slopes on superelevated sections for new construction and reconstruction projects.

### **31-1.08(d) Rollover Factor**

The rollover factor is the algebraic difference in cross slope between the shoulder and travel lanes. The maximum algebraic difference between the traveled way and the shoulder is 8.0% on roads with higher traffic volumes and 10.0% for those roads with lower traffic volumes. See Chapter 32. This applies to both tangent and superelevated sections.

For allowable shoulder rollover values on 3R projects, see Chapter 33.

## **31-2 ROADSIDE ELEMENTS**

### **31-2.01 Borders**

On urban facilities, the border area between the roadway and the right-of-way line should be wide enough to serve several purposes. This includes providing space for sidewalks, snow storage, a buffer space between pedestrians and vehicular traffic, and an area for aesthetic features (e.g., grass, other landscaping), signs, and utilities. If a sidewalk will be constructed or is anticipated in the future, the border should be a minimum of 4 ft (1.2 m) and desirably 8 ft (2.4 m) or wider, plus the sidewalk width. Where the available right-of-way is limited and in areas of high right-of-way costs, as in some industrial and commercial areas, a width of 2 ft (600 mm) plus the sidewalk width may be tolerated.

Where practical, a width of 12 ft to 15 ft (3.6 m to 4.5 m) should be provided between curb and sidewalk, which should remain free of obstacles. In addition to the safety and environmental advantages, this space allows for the future addition of a lane, if needed. (In residential areas, wider building set back controls can also be used to attain these features.)

Typically, a 1 ft (300 mm) minimum width is provided between the sidewalk and right-of-way line. Utility poles usually can be located behind the sidewalk in this area providing a minimum clear sidewalk width of 4 ft (1.2 m).

The slope of the border area is influenced by the surroundings and whether or not a sidewalk (or shared use path) will be provided. If a sidewalk (or shared use path) will be provided, it is aesthetically pleasing to provide a 2% slope for the entire border area. This will match the cross slope of the sidewalk. The direction of the slope, to the curb or away from the curb, is dependent on the surrounding land use and ground elevation beyond the border area. Good economic engineering should be used in determining the best direction to take the water away from the border area. Draining the border area away from the curb in undeveloped area may have advantages. Draining the border area over the curb in developed areas may help the perception of preventing flooding of private property; however, this may increase the required size of the storm sewer system.

If no sidewalk (or shared use path) will be provided or is not anticipated, it is desirable to at least provide a 3 ft to 5 ft wide area with a 2% slope behind the curb. In a cut section, this flat area intercepts and slows the runoff from the higher elevation and provides a storage area from pavement snow removal. In a fill section, this flat area provides additional support for roadway and allows an area for the placement of signs. In both cases this flat area provides a reasonable slope for ease of maintenance and travel way for the occasional pedestrian.

### **31-2.02 Sidewalks**

Sidewalks are considered integral parts of the urban environment. In these areas, travelers frequently choose to make their trip by foot, and pedestrians desire to use a paved surface for the trip. When constructing sidewalks, consider the following:

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1. Guidelines. Consider providing sidewalks on both sides of the street for pedestrians near schools, parks, shopping areas, transit stops, and along all streets located in commercial areas. In residential areas, a sidewalk should be placed on at least one side of all streets. Extend all sidewalks to logical termini. If sidewalks are not provided in the initial design, grading should be completed so that sidewalks can be added in the future.
2. Widths. A typical sidewalk is 5 ft (1.5 m) with a 2 ft to 3 ft (600 mm to 1.0 m) wide buffer area between the curb and sidewalk. If no buffer area is provided, the sidewalk should be 6 ft (1.8 m) wide to accommodate any appurtenances that may be included in the sidewalk. High pedestrian volumes may warrant greater widths in business areas and school zones. The minimum sidewalk width is 4 ft (1.2 m). However, this width must be evaluated against the disabled accessibility requirements presented in Section 41-6.
3. Buffer Areas. If the available right-of-way is sufficient, provide a buffer area between the back of curb and sidewalk. These areas provide space for snow storage and utilities and allow a greater separation between vehicles and pedestrians. The buffer area should be 2 ft to 3 ft (600 mm to 1.0 m) wide to be effective and wider, if practical. Buffer areas may also be used for the placement of roadside appurtenances.
4. Appurtenances. Where a buffer area cannot be provided, consider the impact of roadside appurtenances within the sidewalk (e.g., signs, mailboxes, fire hydrants, parking meters, utility poles). These elements may reduce the effective usable width because they interfere with pedestrian activity.
5. CBD Areas. In central business districts, typically the entire area between the back of curb and the front of buildings is fully paved as a sidewalk.
6. Disabled Accessibility. Sidewalk widths, cross slopes, longitudinal grades, curb ramps, etc., along public rights-of-way must meet the ADA criteria presented in Section 41-6.

### **31-2.03 Side Slopes**

Earth slopes are required to provide a stable transition from the highway profile to adjacent terrain features. With maintenance operations, economy may be attained through the use of mechanized equipment that operates best on relatively flat earth slopes. Flat slopes also facilitate turf establishment and are often required for soil stability. In addition to aesthetic enhancement, flat and well-rounded side slopes, combined with proper roadway elevations above natural ground lines, minimize snow-drifting problems. With proper elevations, crosswinds sweep the snow from the roadway surface, thus facilitating snow removal operations.

Using broad, flat slopes on roadside ditches that are totally visible to the driver lessen the feeling of restriction and add considerably to a driver's willingness to use the shoulder and earth

slope area in emergencies. The use of flat side slopes for roadside ditches reduces both the depth and velocity of water, and thereby minimizes damage from erosion.

Drivers who inadvertently leave the traveled way can often recover control of their vehicles if slopes are gentle and transitions are well rounded. This recovery area should be provided where terrain and right-of-way permit. For additional guidance on roadside safety issues, see Chapter 35.

The tables in Chapter 32 provide the maximum slopes for rural facilities. For urban facilities, side slopes generally will be determined on a case-by-case basis considering the roadside development and right-of-way restrictions. For some urban projects, relatively steep side slopes and/or retaining walls may be required. The stability of the soil may also affect the front and back slopes that can be used in a project.

#### **31-2.04 Ditches**

A roadside ditch is defined as an open channel paralleling the highway embankment within the limits of the highway right-of-way. Its primary function is to collect runoff from the highway and areas adjacent to the highway that drain naturally to the highway and to transport this accumulated water to an acceptable outlet point. A secondary function of a roadside ditch is to drain the base of the roadway to prevent saturation and loss of support for the pavement. When designing ditches, consider the following:

1. Types. There are basically two types of ditches — V-ditch or flat-bottom ditch. Flat-bottom ditches are typically a minimum of 2 ft (600 mm) wide.
2. Side Slopes. The rural tables in Chapter 32 provide the recommended side slope designs for ditches.
3. Roadside Safety. Chapter 35 presents safety criteria for roadside drainage features.
4. Ditch Grades. Ensure that permanent erosion control is considered in the design of ditches in cut slopes. As a general guide, longitudinal ditch slopes less than 1.0% can be seeded, slopes of 1.0% to 3.0% usually will require sodding or seeding with an erosion control blanket, and slopes greater than 3.0% will require riprap or other protective lining. Very flat longitudinal ditch slopes (i.e., < 0.4%) may require a paved ditch to maintain the flowline over time.

For more information on the design of ditches, see Section 38-1 in this *Manual* and the *IDOT Drainage Manual*.



### **31-3 RIGHT-OF-WAY**

#### **31-3.01 General**

The purpose of acquiring highway rights-of-way is to provide sufficient room to construct the facility, to enable the safe operation of vehicles on the facility, and to permit the safe and efficient maintenance of the facility. Give consideration to future widening, sidewalks, and bike paths.

#### **31-3.02 Right-of-Way Width**

For new facilities, the minimum right-of-way width will be the sum of the traveled way, outside shoulders and/or curb and gutter width, median width (if applicable), necessary width for fill and cut slopes, sidewalks (if applicable), public utility facility strip, plus a maintenance border area beyond the construction limits. Except for townships, the total width will vary according to the functional classification and urban/rural environment. Townships are required to have a minimum width of 40 ft (12 m) (605 ILCS 5/6-301). In addition to the border area beyond the construction limits, allowance may be necessary for the provision of frontage roads, special drainage facilities, roadside clear zones, and future expansion of the highway. These border areas are required for maintenance operations, the retention of natural growth for scenic and ecological purposes, erosion control and, in some cases, for accommodating publicly owned utilities. Border areas also serve as a buffer between the limits of construction and abutting private development.

In rural areas, wide rights-of-way allow the construction of flat slopes, resulting in enhanced safety for the motorist and providing for easier and more economical maintenance. The procurement of sufficient rights-of-way at the time of the initial improvement permits the widening of the roadway and the widening and strengthening of the pavement at reasonable costs as traffic increases.

In urban/suburban areas, it may be more desirable to limit the right-of-way width to the practical minimum. However, the right-of-way should not be less than that required for all elements of the design section and appropriate border areas. The acquisition of additional right-of-way for municipal improvements with rural-type cross sections in built-up areas may not be practical where property damage would be large if standard slopes are constructed. However, where rural conditions exist in municipalities, use the widths for the traveled way and shoulders and slope rates from the applicable rural table in Chapter 32 to determine the minimum right-of-way width.

In general, minimal additional right-of-way will be required for 3R projects. However, ditch cleaning and slope flattening may be desirable on these projects. Consequently, strips of a minimum width of right-of-way or easements may be required.





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**31-4 REFERENCES**

1. *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2004.
2. Chapter 34, "Cross Section Elements," *Bureau of Design and Environment Manual*, IDOT.
3. *IDOT Drainage Manual*, Bureau of Bridges and Structures, IDOT.
4. *Roadside Design Guide*, AASHTO, 2002.
5. *Guidelines for Residential Subdivision Street Design, A Recommended Practice*, Institute of Transportation Engineers.
6. *Capacity and Operational Effects of Midblock Left-Turn Lanes*, NCHRP 395.

